Contribution to the Stakeholders Needs and Expectations Transfer into Project Activities.

Rafael Granillo Macías
Industrial and Systems Engineering Department, Instituto
Tecnológico y de Estudios Superiores de Monterrey.
Campus Estado de México
Atizapán de Zaragoza, 52926, Estado de México, México.
a01005258@itesm.mx

and

Alejandro Sandoval Correa
Industrial and Systems Engineering Department, Instituto
Tecnológico y de Estudios Superiores de Monterrey.
Campus Estado de México.
Atizapán de Zaragoza, 52926, Estado de México, México.
alesando@itesm.mx

ABSTRACT

Among the methodologies for project management proposed by organizations such as the International Project Management Association (IPMA) or the Project Management Institute (PMI), it is mentioned that the most important factor related to the project success is represented by the adequate attraction of the stakeholder's necessities. Nowadays the only way proposed to follow up the expectations of the stakeholders is their inclusion in the communication plans as well as in proposals focused to its classification, categorization, and identification. Basically the key stakeholder's expectations are attracted without pointing out the way to model or express them inside the project into a Work Breakdown Structure (WBS).

It is then pertinent to propose complementary techniques and tools in order to identify, clarify and mapping the stakeholder's perceptions, since those perceptions guide the selection of the project's whole activities that must fulfill, in an effective and aligned way the restrictions, requirements and expectations.

This article presents, by exploring some techniques used for mapping, an identification and analysis of the stakeholder's expectations. It proposes a way to solve the weakness regarding the transference of expectations in order to attract the key stakeholders into the project activities structure by using, a tool not originally used in the project management field, the Axiomatic Design method.

Keywords: Stakeholders, Stakeholders management, Axiomatic Design, Work Breakdown Structure (WBS), Project management.

1. PROJECT SUCCESS THROUGH THE PROJECT STAKEHOLDERS.

The main attribute and support for the project success depends on the project management strategy. This strategy must be aligned to requirements of the stakeholders and also it has to respond to them [22]. The project has to be perceived as successful according to the satisfaction reached by the stakeholders [24]. The project Management Institute expresses the term stakeholder, defined by the PMBoK[16] as "individuals and organizations that are actively involved in the project or whose interests may be affected as a result of project execution or project completion". This means that those human factors which have direct or indirect influence along the project development are those who establish the requirements or restrictions inside the project configuration [6].

It is, then, necessary to consider the current reference frame of the stakeholders in order to define their requirements and necessities, and the way they can impact the project. According to Pinto [15], the Stakeholders identification makes more comprehensive the project processes groups. This idea, seen from the organization internal environment, can determine which groups of stakeholders can impact directly the operation, as well as the way in which these groups can influence a project implementation.

The stakeholder can assume different roles inside the organization and his or her ability to influence it, can increase or decrease, as a consequence of the constant organizational change of work structures and ways of production [15]. In the same way, the International Project Management Association (IPMA) [13] mentions that taking into consideration the group of interests that concern to the stakeholders and verifying that they reach their expectations inside each phase of the project, the probabilities of success of the project can be better.

The Project Management Body of Knowledge (PMBoK) [16] mentions that the attraction of the Stakeholders necessities and expectations gives the goals and objectives inside the project plan.
Once the importance of the stakeholders has been defined for the project success, the description and characteristics of some models for management are presented. These models are developed nowadays in order to satisfy the management and attraction of the stakeholders' expectations through the processes of a specific nature of project.

2. MODELS TO ATTRACT THE STAKEHOLDER'S EXPECTATIONS.

Usually, the way to quantify the stakeholders impact is related to the project own restrictions (cost-time-quality). This is because the time phase, where changes occur, will be related to the increase of the costs, so if any change in the project

configuration initial phases is done it will have a lower cost in comparison with any change done in the subsequent phases [16].

In this way, the consideration and comprehension of the way how the interested parties will act will be one of the critical factors for the project management [14].

The main support for the stakeholders' management, trying to understand their imposed requirements and restrictions, is included, in most of the projects, in the communication plan development. This plan supports the stakeholders' necessities management processes and identifies the group of requirements, restrictions and organizational environment. All of them are taken into consideration during the initial processes of project planning [16]. After planning, for the execution, different communication methods are applied eventually along the project. So, with these methods we only focus in the communication as a methodology to attract the information between the stakeholders.

The communication is define in the IPMA [13], as a process inside the project structure. This structure is based in processes that go from the main Stakeholders identification to the communication plan development, passing by the evaluation and feedback of the learnt lessons in order to apply them in other projects.

The relative importance of the stakeholders' commitment and alignment with the project vision and mission has been expressed through the promotion of methodologies and tools [9]. In order to visualize in a better way the stakeholders' impact over the project processes, which tend to strength the communication plans, this identification processes are developed only in their initial phases.

Consequently, a lot of projects fail because the mapping, communication, and evaluation of necessities does not continue in further processes as support for the vision and project objectives [3]

In this chart there are some methods presented for the management and attraction of the stakeholders' necessities without being restrictive (Table 1).

Methodology	Author	Characteristics	Strengths
Stakeholders Identification and management	Elliot [11], Svendsen [19]	A robust methodology capable to support planning processes.	It is useful to detect stakeholders during the planning phase.
Definition of categories of stakeholders	Savage and Michell [18]	Generic type frames (Support, indifferent, not collaborative, marginal)	It expresses the stakeholders' dimension according to the categories.
Comprehensive stakeholder identification, assessment, and engagement.	Cleland [7]	Identification of the Stakeholders and their interests.	It measures its interests tending to predict the future behavior of the stakeholders and their impact in the project and in the own work team.
Expectations Mental Maps	Chamoun [8]	Process based on mental maps representing the stakeholders and their expectations	It is a simple model that allows visualizing in a schematic way the stakeholders' necessities.
Stakeholders 360	Svendsen and Boutiller [19]	Based on metrics and diagnosis of the strategies.	It provides information in order to prevent further problems in the organization.
Stakeholder cycle	Bourne and Alter [3]	Continual process with long term commitment strategy.	It is a model that identifies and arranges the priorities of the stakeholders' necessities through the project.

Table 1. Methodologies for the stakeholders' management.

Analyzing these models, we can see that each one presents some strength in projects with certain characteristics, and it is possible to compose them according to the project scope. One weakness in common that these models have is that they assume that the activities to reach the stakeholders' expectations will be based in the opinion of the project leader or in the work team that the PMBoK [16] proposes as tool. This causes to fall in a process that doesn't assure the agreement between the things that you desire to reach and how to represent them in the project activities structure.

According to the previous information, the decision will be relied in the expert's opinion, which can't assure at any moment that these activities really respond to the key stakeholders' necessities.

The work team, inside the project, identifies the stakeholders' requirements in its initial phases. In the further processes the changes in the power of influence and relative position of the main stakeholders is not recognized through its own life cycle [3]. The previous information has a consequence, which is to do inappropriate adjustments in the project activities. As a result, the project activities configuration known as Work Breakdown Structure (WBS) is modified and susceptible to present problems [17] such as:

1. Project deadline lost and an infinite extended programming.
2. Projects out of the budget.
3. Changes in the project scope.
4. The project team members are confused about which are their individual responsibilities.
5. Inadequate assignment of resources in order to cover unexpected situations.

According to the previous information, it is important that later on the stakeholders' expectations attraction must be transformed into associate activities.

In this article it is proposed a methodology supported in the axiomatic method, in order to visualize the requirements as an entrance and the personalized activities as an exit. This is done to accomplish in each step of the project process the stakeholders' requirements, and also to reduce the possibility of failing towards the project goals fulfillment. The characteristics that are offered by the axiomatic design are described in the next point.

3. CONTRIBUTION OF THE AXIOMATIC DESIGN AS A TOOL TO THE ATTRACTION OF STAKEHOLDER'S REQUIREMENTS.

The Axiomatic Design (AD) is a methodology developed by Nam Pyo Suh [21], whose goal is to establish a scientific base to provide a systematic and logic method to document, derive, and optimize the solution design by searching the best option.

The AD is based in the design principles, which indicate the interaction between "What we want to achieve" and "How we want to achieve it". It exist a clear description between them that has as origin the comprehension of the customers' requirements. These requirements will be transformed into a "minimum" group of specifications that Nam Suh defines as functional requirements (FR). These requirements describe "The things that we desire to reach" to satisfy the customers' necessities.

The creation of this objective is established by both: the functional requirements (FR), and the restrictions (Cs). So the FR and the Cs are used as an entrance to the parameter design (DP's) inside a system in which the FR's are satisfied. One particular set of DP's, responding to one FR, can be considered as "variables of processes" (PV's) into the next process domain.
The AD within their methodology uses as principles bases, the method of design of objects focused in the concept of domains [20] where the guide of the theory of the axiomatic design is originated of 2 axioms of design:

• The axiom of independence (To maintain the independence of the FR`s)
• The axiom of the information (To reduce the context of the information).

The AD by itself can be used as a tool for designing objects no related with engineering such as technology strategies, business plans, and organizations [12], [20].

The FR's can be renamed as "goals", the DP's as "activities", and the PV's as "strategies".

From the main characteristics of the AD those that can be useful for the project management are the following:

- The AD principles applied in the tasks assignment tend to minimize the costs related with the interaction for the systems design [2].
- The AD, also supplies a systematic flow for the creation of concepts to give the design details through the requirement process decomposition and solutions design [10]. These provide a design transformation when changes are introduced during the development phase through the product life cycle [1].

AD limitations

According to Suh [20], the main entrance to feed the AD, comes from the designer himself. For this reason it is important that the information used as input element is reliable and able to represent a description about what we want to achieve. In order to solve this possible limitation from the AD we propose the use of the existing Stakeholders expectations integration methodologies. Those methodologies will allow AD to get a customized entrance in order to design the required activities. This proposal of integration is presented in the next section.

4. AD CONTRIBUTIONS TO THE PROJECT MANAGEMENT

As it was mentioned before, one main AD limitation is, first of all, to know the Stakeholder requirements and then to be able to propose a set of the most appropriate activities capable to satisfy the detected expectations [2].

This approach to the integration of AD shown in the Table 2, which starts with "Stakeholders expectations integration methodologies" [A] entry to that comes from the stakeholders involved in the project, as described in the "Stakeholders" [B], which is associated with certain requirements transferred into "Goals / Attributes" [C]; So the functional domain of the project will then become of all the FR and that should be associated with certain DP since the approach for managing projects will be able to rename them characteristics of a WBS that respond to the needs expressed by the stakeholders.

This process, in the functional and physical domains, is based on the interaction of AD focused on the search for the best solution that covers the expressed project requirements remaining as part of the project's strategies.

Axiomatic Design			
Customer domain	Functional Domain	Physical Domain	Process Domain
CA's	FR's	DP's	PV's
Approach Project Management			
Stakeholders [B]	Goals / Attributes [C]	Activities (WBS) [D]	Strategies [E]
CA_1 Customers CA_2 Investors CA_3 Sponsor CA_4 Member's Team CA_5 Supplier	FR_1 Quality. FR_2 Profits. FR_3 Cost FR_4 Time FR_5 Profits	DP_1 User support $DP_{1.1}$… DP_2 ROI Analysis $DP_{2.1}$… DP_3 Cost Budgeting $DP_{3.1}$… DP_4 Schedule Development $DP_{4.1}$… DP_5 Activity Cost $DP_{5.1}$… …	PV_1 Added value PV_2 Financial plan PV_3 Cost Management Plan PV_4 Project time management. PV_5 Contract Type
Subjects [23]	Objects [23]		Processes [23]

The following part spans the full width under "Stakeholders expectations integration methodologies [A]":

Initiation Process [16]	Planning Processes [16]			
	Scope Definition	Costs Definitions	Resources Definition	Risks Definition
Evaluation				

Table 2. AD integration into the project configuration.

5. INTEGRATION BETWEEN THE METHODOLOGIES OF STAKEHOLDERS AND DESIGN AXIOMATIC.

The integration research, begins by selecting the appropriate method of administration of stakeholders according to the nature of the project, which could identify the stakeholders involved in the project, prioritizing and assessing their importance within the same project, in this way stakeholders can be grouped according to certain characteristics as mentioned by Murray [14] and Bourne [3, 4], which include:

• Proximity.
• Power.
• Influence.
• Urgency, among others.

Thus, the key stakeholders can be prioritized in order to support the project' success, by moving them to be part of a certain domain called by the AD the "Customer domain" (CA).

This first domain, will consist of stakeholders representing the project, which we could call CA_j where "j" indicate the jth key stakeholder involved in the project.

Once identified the key stakeholders of the project and its requirements, they will be transferred into goals/attributes associated with the domain of the customer, i.e. each CA_j will be expressed by a set of requirements or FR's (as in quality, utilities, time, among others), these FR's must be represented in a hierarchical manner as Suh notes. This hierarchy can be established through the prioritization of the stakeholders involved in the project.

Schematically, hierarchical goals / attributes can be represented as shown in the figure below.
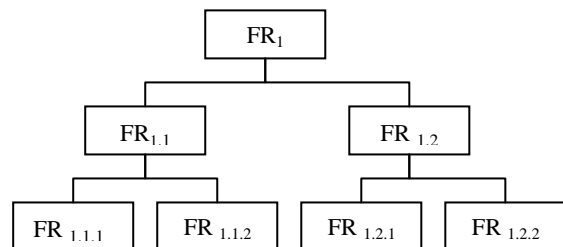

Figure 1. Mapping FR's.

From the chart above, we note that the FR's higher levels, will be linked to other FR's in the lowest levels, for example if the FR_1 indicates an attribute expressed by clients linked to the quality, in particular this will be associated in turn to the $FR_{1.1}$ and $FR_{1.2}$ which in this case could be related quality metric, the same way every FR at this level is related to lower levels of attributes.

Once developed this functional domain, the analysis begins on the activities domain or DP's, which is a breakdown of activities to be carried out under the project, in general we can say that this activities break down (WBS) should be constructed based on the FR's raised in the previous domain.
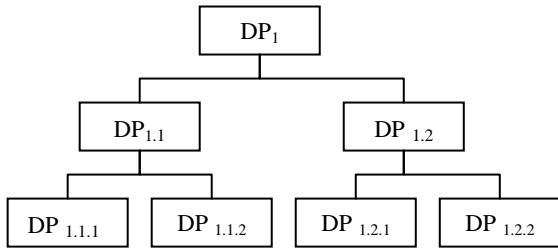
Figure 2. Mapping DP's.

Thus, based on the "domain theory" mentioned by the AD, it will take at this point a "domain" consisting of the main goals or attributes expressed by the key stakeholders and in turn, it will take another "domain" formed by the breakdown of activities related to the project.

As a next step based on the AD, it is required to link the goals / attributes to the activities in such a way as to be able to locate those activities which will impact on various goals/ attributes, through a process known as zigzag.
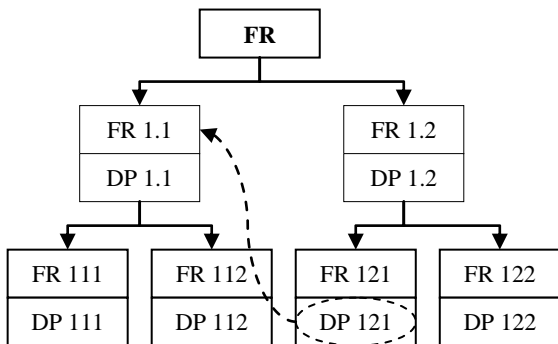

Figure 3. FR's affect other DP's

This relationship comes from the first axiom of AD, known as the "axiom of independence", whose main feature is to adjust each activity (DP) in order to meet its goals/ attribute (FR) without actually affecting other goals /attributes. In particular, this relationship can be expressed under different scenarios [20], where the ideal solution meets for each DP only one FR, without affecting other DP's.

This relation between the key stakeholders' goals/ attributes can be observed through a design matrix, as it is shown below: (Figure 4).

$$\begin{Bmatrix} FR_1 \\ FR_2 \\ FR_3 \end{Bmatrix} = \begin{bmatrix} X & 0 & 0 \\ 0 & X & 0 \\ 0 & 0 & X \end{bmatrix} \begin{Bmatrix} DP_1 \\ DP_2 \\ DP_3 \end{Bmatrix}$$

Figure 4. Design matrix. Ideal Case [21]

The figure 4 shows the ideal case where we note that for the first level, the FR_1 is satisfied and only affected by the DP_1. However exist in the case where a DP affect more than one FR in this case will have a configuration like the one shown in Figure 5.

$$\begin{Bmatrix} FR_1 \\ FR_2 \\ FR_3 \end{Bmatrix} = \begin{bmatrix} X & 0 & 0 \\ X & X & 0 \\ 0 & 0 & X \end{bmatrix} \begin{Bmatrix} DP_1 \\ DP_2 \\ DP_3 \end{Bmatrix}$$

Figure 5. Design matrix. DP affects more FR [21]

This last characteristic can be used in project management, enabling traceability of activities and how these may affect the requirements of stakeholders in the case of one activity affecting two or more stakeholders; this can be identified in the matrix design (Figure 5).

This concept of AD in turn, may allow us to locate those activities with the same attribute /goals, which would entail eliminating similar activities that generate the same result for different stakeholders, this statement can stand on the concept of Weltanschauung [5], where it can be said that there is a shared vision among stakeholders, which makes it possible to integrate activities, which result into a reduction of the number of activities in the project (WBS).
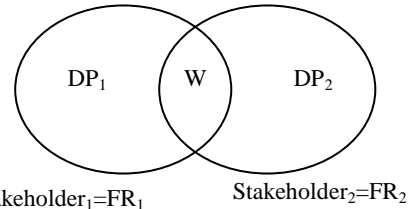

Figure 6. Activity that shares the same attribute/goal [21].

It is important to point out that taking the stakeholders' methodologies as FR's definition entrances, represent an important characteristic that joins the reality over the scenario and the characteristic authors that emerge from the particular nature of the project.

Generally they have to be evaluated and expressed in the project. The AD establishes a link with this entrance and tries to assure its transference between the FP's into DP's.

Other feature within the AD is related to the DP's, which we have defined as activities: When goals (related to DP's) are lower than attributes/goals defined by the stakeholders (FR). In this case we have a matrix as shown in Figure 7.

$$\begin{Bmatrix} FR_1 \text{ Stakeholder 1} \\ FR_2 \text{ Stakeholder 2} \\ FR_3 \text{ Stakeholder 3} \end{Bmatrix} = \begin{bmatrix} X & 0 & 0 \\ 0 & X & 0 \\ X & 0 & X \end{bmatrix} \begin{Bmatrix} DP_1 \\ DP_2 \end{Bmatrix}$$

Figure 7. Without solution mapping between Activities – Attributes/Goal

According to figure 7, DP's are less than FR's and algebraically there is no solution to this approach. From the project management perspective, it proposes an interesting mathematic condition where, in order to make a project feasible and to achieve success, there must exist consistency between requirements and the activities associated to them.

Once you have the FR's as potential solutions obtained under the independence axiom; they are evaluated under the axiom of the information, indicating that the option selected must be the one with more probabilities of success.

This axiom is based on the fact that there is a "design range" as well as a "system range", it is, there are limits or restrictions between operating a workable solution for a certain configuration between DP's and FR's.
Finally, it is noted that this process should be followed up to the strategic domain (PV).

The final objective, which supposes the AD integration with the stakeholders' management inside the project configuration, will be the construction of one strategy

according to one WBS aligned with the main stakeholders' necessities trough the project.

First of all, it is suggested to know the requirements and the project's key stakeholders. This represents a personalized entrance that offers one advantage for the requirements mapping, which is processed through the axioms proposed by Suh [20].

So, an important integration will be generated between "the things we desire to reach" and "how to reach them". This is transformed in searching the reduction in costs/time associated with these activities of the project and a better attraction of the requirements inside the activities configuration.

CONCLUSION

By means of a methodology with scientific support, as the AD is, it is possible to transfer the stakeholders' requirements into satisfactory and aligned activities with the project strategy. Assuming that the AD requires information according to the necessities, it is possible to do a complement to its integration through the information proposed by the methodologies for the stakeholders' attraction.

Since these methodologies evaluate the stakeholders, it is possible to do this evaluation functions as a personalized entrance according to what is expected about the project. After the identification of the main attributes/goals, we must be able to represent, in the project configuration, the particular expectations and restrictions. These expectations and restrictions must to be expressed by the key stakeholders involved during the process groups of a specific project.

With integration between the stakeholders' attraction and a method like the AD, it is possible to identify similar activities that carry out the same attribute between different key stakeholders. This means an important reduction in the activities planning and a better conceptualization in a project configuration, which serves as a system for taking decisions. The system is complementary to the "experts' opinion" as it is proposed by the current methodologies for project management.

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